



## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<b>(51) International Patent Classification 5 :</b> <b>A24B 15/10, 15/28</b>	<b>A1</b>	<b>(11) International Publication Number:</b> <b>WO 91/18525</b> <b>(43) International Publication Date:</b> 12 December 1991 (12.12.91)
<b>(21) International Application Number:</b> PCT/SE91/00385 <b>(22) International Filing Date:</b> 3 June 1991 (03.06.91) <b>(30) Priority data:</b> 9002052-0                      8 June 1990 (08.06.90)                      SE <b>(71) Applicant (for all designated States except US):</b> KABI PHARMACIA AB [SE/SE]; S-751 82 Uppsala (SE). <b>(72) Inventor; and</b> <b>(75) Inventor/Applicant (for US only) :</b> ANDERSSON, Sven, Börje [SE/SE]; Tuvegatan 14, S-260 35 Ödåkra (SE). <b>(74) Agent:</b> THYLÉN, Eva; Kabi Pharmacia Therapeutics AB, Box 941, S-251 09 Helsingborg (SE).		<b>(81) Designated States:</b> AT, AT (European patent), AU, BB, BE (European patent), BG, BR, CA, CH, CH (European patent), DE, DE (European patent), DK, DK (European patent), ES, ES (European patent), FI, FR (European patent), GB, GB (European patent), GR (European patent), HU, IT (European patent), JP, KP, KR, LK, LU, LU (European patent), MC, MG, MW, NL, NL (European patent), NO, RO, SD, SE, SE (European patent), SU, US.  <b>Published</b> <i>With international search report.</i>
<b>(54) Title:</b> SMOKING COMPOSITION  <b>(57) Abstract</b>  The invention concerns a smoking composition comprising nicotine in the form of an inclusion complex formed between a cyclo compound and nicotine.		

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Smoking composition

5       The present invention concerns a smoking composition with high nicotine content.

Background of the invention

10       Excessive smoking is now recognized as one of the major health problems throughout the world. The most advantageous thing a heavy smoker can do is, therefore, to reduce or preferably even stop smoking completely. Experience shows, however, that most smokers find this extremely difficult. It is generally accepted that this difficulty results from the  
15       fact that heavy smokers are dependent on nicotine, which is considered to be one of the risk factors in tobacco smoke. The most important risk factors, however, are substances which are formed during the combustion of tobacco, such as carbon monoxide, tar products, aldehydes, and hydrocyanic  
20       acid. However, when trying to decrease tar and other harmful substances in the smoke by modifying the cigarette tobacco or using different filters it seems as if also the amount of nicotine is reduced. For the smoker it is, generally undesirable to diminish the amount of nicotine as he tends to compensate the lower amount of nicotine with more intense  
25       smoking and deeper puffs. In the end it is therefore often so that the smoker inhales the same amount of harmful components in spite of the fact that the cigarette is "cleaner". Therefore, if nicotine in a suitable form could be incorporated in a tobacco product and if this nicotine was released  
30       by the heat from the glow and incorporated in the smoking particles this could perhaps suppress the smoker's wish to increase the inhalation volumes. The consequence would then be that the amount of nicotine is unchanged while the amount  
35       of harmful substances is reduced.

Summary of the invention

5 The invention concerns a smoking composition wherein nicotine in the form of an inclusion complex formed between a cyclo compound and nicotine is incorporated into a smoking material such as ordinary tobacco, a nicotine-free herbal material or low tar tobacco. The cyclo compound is preferably a polysaccharide such as a  $\alpha$ -,  $\beta$ - or  $\gamma$ -cyclodextrin.

10 Cyclodextrins have previously been used in tobacco products. It is thus known from e.g. the US patent 3,047,431 to incorporate flavoring materials in the form of inclusion complexes into tobacco materials. Cyclodextrins have also been suggested as additive to cigarette filter materials for absorption of nicotine and tar (cf DE 2 527 234 and JP 15 51032799).

The cyclodextrin inclusion complexes can be prepared according to methods well known to a person skilled in the art. 20 The most common procedures comprise stirring or shaking of an aqueous solution of the particular cyclodextrin with the nicotine. The reaction is preferably carried out in a common solvent like water.

25 According to the invention the inclusion complex can be mixed with tobacco or a nicotine-free smoking material. Alternatively the complex is placed in a defined volume optionally in the form of plug in connection with a filter. It is also possible to have the inclusion complex in the form of a 30 separate elongated tube along the inside of the cigarette paper or as a layer on the inside of the cigarette paper.

The invention is further illustrated by the following examples:

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Example 1

Preparation of inclusion complex of  $\beta$ -CD and nicotine ( $\beta$ -CD-N).

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100 g water were heated to 75°C. 28 g of  $\beta$ -CD were added and dissolved while stirring the solution. 3.5 ml of nicotine were added. The mixture was stirred for about 4 h at ambient temperature. The obtained mixture was filtered and dried in a drying oven at 35°C.

Example 2

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A conventional pipe was provided with herbal material obtained from Honeyrose de Luxe Herbal Cigarettes. This material is guaranteed nicotine-free according to the information on the cigarette package and was used in the present experiment in order to see if nicotine from the inclusion complex was actually released. If ordinary tobacco had been used it would have been difficult to estimate the amount of nicotine from the tobacco and the amount of nicotine from the inclusion complex. To the herbal material was added 60 mg of nicotine- $\beta$ -cyclodextrin (equivalent to  $60 \times 0,115 = 6,9$  mg of nicotine) and additional nicotine-free herbal material was packed on the complex. About 0,35 g of herbal material was used in each experiment. No inclusion complex was added in the control experiments.

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The pipe was lit and air was drawn through the herbal material by using a gastight syringe. The whole amount of the herbal material including the inclusion complex was smoked in puffs of 50 ml by using the syringe. 15-18 puffs were drawn before the material was completely used up.

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The smoke was conveyed through an aqueous solution of 10 ml of 0.05 M  $H_2SO_4$  wherein the nicotine was trapped. The solution was analyzed with respect to nicotine and the following results were obtained:

	Exp.	Sample	Released nicotine/mg
	1	herbal material + $\beta$ -CD-N	0,68
	2	" " + "	0,76
5	3	" "	0,08*
	4	" "	0,05*

\* residual nicotine from earlier experiments carried out in the equipment

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The experiments 1 and 2 indicate that nicotine is released from the inclusion complex and is actually bound to the smoking particles when these are formed. If this had not been the case the nicotine had never reached the smoker but had condensed and been absorbed on the way through the pipe.

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In the experiments 3 and 4 small amounts of nicotine were found. Most likely these amounts originates from earlier experiments involving nicotine carried out in the equipment.

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## CLAIMS

1. Smoking composition comprising nicotine in the form of an inclusion complex formed between a cyclo compound and nicotine and a smoking material, which composition releases nicotine when it is subjected to elevated temperatures.
- 5 2. Composition according to claim 1 wherein the cyclo compound is a cyclized polysaccharide, preferably a cyclodextrin.
3. Composition according to claim 2 wherein the cyclodextrin is  
10  $\beta$ -cyclodextrin.
4. Composition according to any of the preceding claims wherein the smoking material is low tar tobacco.
- 15 5. A method of imparting nicotine to a smoking material comprising forming an inclusion complex between a cyclodextrin compound and nicotine and thereafter combining said smoking material with said inclusion complex whereby the nicotine is rendered stable within said smoking material until such time as the material is subjected  
20 to elevated temperatures.

# INTERNATIONAL SEARCH REPORT

International Application No PCT/SE 91/00385

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (if several classification symbols apply, indicate all) <sup>6</sup> According to International Patent Classification (IPC) or to both National Classification and IPC IPC5: A 24 B 15/10, A 24 B 15/28																	
<b>II. FIELDS SEARCHED</b> <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black;">Minimum Documentation Searched<sup>7</sup></div> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 25%; border-bottom: 1px solid black;">Classification System</th> <th style="border-bottom: 1px solid black;">Classification Symbols</th> </tr> <tr> <td style="height: 40px; vertical-align: bottom;">IPC5</td> <td style="vertical-align: bottom;">A 24 B</td> </tr> </table> <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black;">Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in Fields Searched<sup>8</sup></div> <p>SE,DK,FI,NO classes as above</p>			Classification System	Classification Symbols	IPC5	A 24 B											
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<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT<sup>9</sup></b> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 10%; border-bottom: 1px solid black;">Category *</th> <th style="border-bottom: 1px solid black;">Citation of Document,<sup>11</sup> with indication, where appropriate, of the relevant passages<sup>12</sup></th> <th style="width: 15%; border-bottom: 1px solid black;">Relevant to Claim No.<sup>13</sup></th> </tr> <tr> <td style="text-align: center; vertical-align: top;">Y</td> <td>US, A, 3047431 (ABRAHAM BAVLEY ET AL) 31 July 1962, see the whole document --</td> <td style="text-align: center; vertical-align: top;">1-5</td> </tr> <tr> <td style="text-align: center; vertical-align: top;">Y</td> <td>US, A, 3288146 (ABRAHAM BAVLEY ET AL) 29 November 1966, see the whole document --</td> <td style="text-align: center; vertical-align: top;">1-5</td> </tr> <tr> <td style="text-align: center; vertical-align: top;">Y</td> <td>ANALYTICAL CHEMISTRY, Vol. 56, No. 14, 1984 Soon M. Han et al: "Solute-Induced Circular Dichroism: Drug Discrimination by Cyclodextrin", see page 2826 - page 2830 especially page 2828 --</td> <td style="text-align: center; vertical-align: top;">1-5</td> </tr> <tr> <td style="text-align: center; vertical-align: top;">A</td> <td>FR, A, 2275161 (KIICHI ARAKAWA) 16 January 1976, see the whole document -- -----</td> <td style="text-align: center; vertical-align: top;">1-5</td> </tr> </table>			Category *	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>	Y	US, A, 3047431 (ABRAHAM BAVLEY ET AL) 31 July 1962, see the whole document --	1-5	Y	US, A, 3288146 (ABRAHAM BAVLEY ET AL) 29 November 1966, see the whole document --	1-5	Y	ANALYTICAL CHEMISTRY, Vol. 56, No. 14, 1984 Soon M. Han et al: "Solute-Induced Circular Dichroism: Drug Discrimination by Cyclodextrin", see page 2826 - page 2830 especially page 2828 --	1-5	A	FR, A, 2275161 (KIICHI ARAKAWA) 16 January 1976, see the whole document -- -----	1-5
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<div style="display: flex; justify-content: space-between;"> <div style="width: 48%;"> <p><b>* Special categories of cited documents:<sup>10</sup></b></p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 48%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&amp;" document member of the same patent family</p> </div> </div>																	
<b>IV. CERTIFICATION</b> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; border-bottom: 1px solid black;">Date of the Actual Completion of the International Search</td> <td style="width: 50%; border-bottom: 1px solid black;">Date of Mailing of this International Search Report</td> </tr> <tr> <td style="height: 40px; vertical-align: bottom;">30th August 1991</td> <td style="vertical-align: bottom; text-align: center;">1991 -09- 11</td> </tr> <tr> <td style="border-bottom: 1px solid black;">International Searching Authority</td> <td style="border-bottom: 1px solid black;">Signature of Authorized Officer</td> </tr> <tr> <td style="text-align: center; vertical-align: bottom;">SWEDISH PATENT OFFICE</td> <td style="text-align: center; vertical-align: bottom;">             Ingrid Falk         </td> </tr> </table>			Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	30th August 1991	1991 -09- 11	International Searching Authority	Signature of Authorized Officer	SWEDISH PATENT OFFICE	 Ingrid Falk							
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**ANNEX TO THE INTERNATIONAL SEARCH REPORT  
ON INTERNATIONAL PATENT APPLICATION NO. PCT/SE 91/00385**

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the Swedish Patent Office EDP file on **91-07-31**.  
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A- 3047431	62-07-31	NONE	
US-A- 3288146	66-11-29	BE-A- 650271	64-11-03
		CH-A- 459038	00-00-00
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